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# SEAMPLAN

COMPUTER-BASED  
MINE & RECLAMATION  
PLANNING SYSTEM



A cooperative effort between the Forest Service,  
USDA, and Montana State University, Bozeman

7/13/90

## WHY COMPUTERIZED PLANNING?

- Large scale surface mining in the western United States is relatively new and mine planning and reclamation strategies are not well established.
- Planning for profitable surface mines with effective reclamation and minimal environmental impacts is a complex activity involving many steps.
- Data management by computer to store and access various types of information is several orders of magnitude faster than manual data processing.
- Changing site conditions require the ability to develop alternative mine designs and reclamation strategies within the constraints of environmental protection.
- SEAMPLAN combines the speed and accuracy of the computer with the professional judgment of the operator to develop a powerful interactive planning tool.
- Primary advantages of the SEAMPLAN system are:
  - (1) Relieves highly trained people of routine and repetitive work.
  - (2) Allows rapid and accurate evaluation of large numbers of alternatives in the design and reclamation phases of mining.
  - (3) Shortens the time required for processing and approving mine plans.

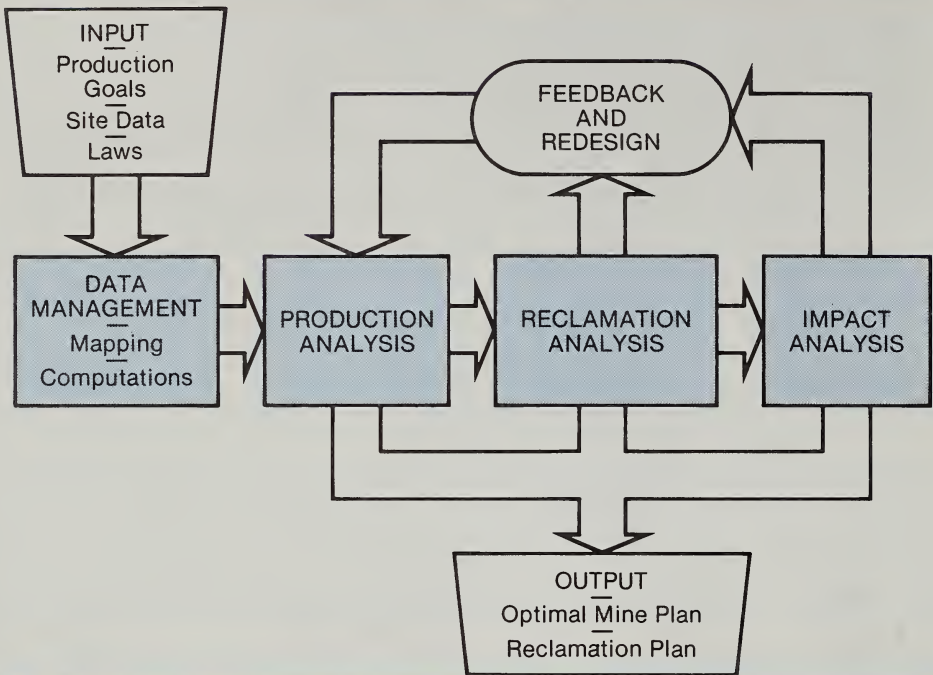
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USDA Forest Service  
Miscellaneous Publication INT-1  
Intermountain Forest and Range Experiment Station  
Forest Service, U.S. Department of Agriculture

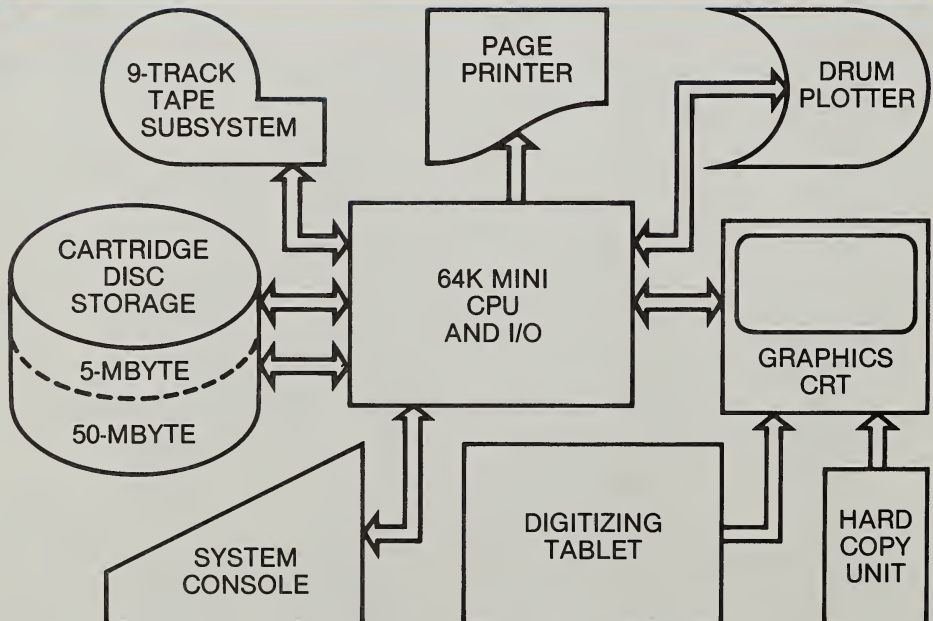
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# HOW SEAMPLAN WORKS

SEAMPLAN has four major components as shown below:



# THE MINICOMPUTER SETUP



# DATA MANAGEMENT

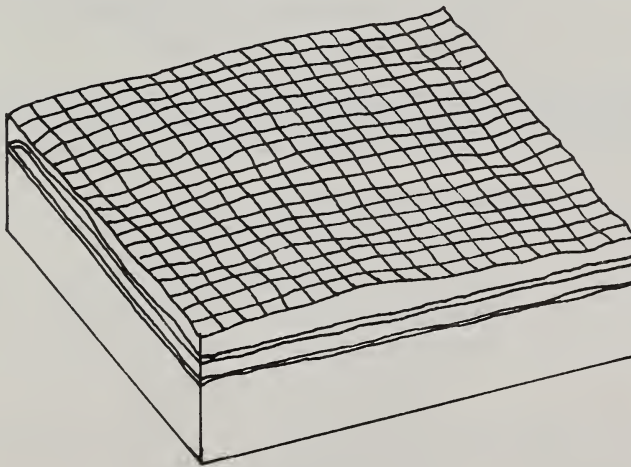
- Each analysis module in the system can quickly access required data.
- Data describe the chemical and physical characteristics of overburden and coal; the soil, hydrology, climate, vegetation, wildlife, and mining equipment.

The user may edit or add to data files.

- Programs were designed or adapted to fully develop the interactive link between the computer and the geologist.
- Three dimensional perspectives, contour plots, bar charts, cross-sections, listings, and computational summaries can be prepared and displayed in minutes.

## TOP SOIL

PHI = 25 THETA = 35



OVERBURDEN  
ROSEBUD — MCKAY  
ROBINSON

	AVERAGE	MINIMUM	MAXIMUM
OVERBURDEN ELEVATION	3567	3469	3665
OVERBURDEN THICKNESS	64	0	170
ROSEBUD — MCKAY THICKNESS	34	0	109
ROBINSON THICKNESS	17	8	39
DIMENSIONS: 1900' x 1800', GRID SPACING 100'			



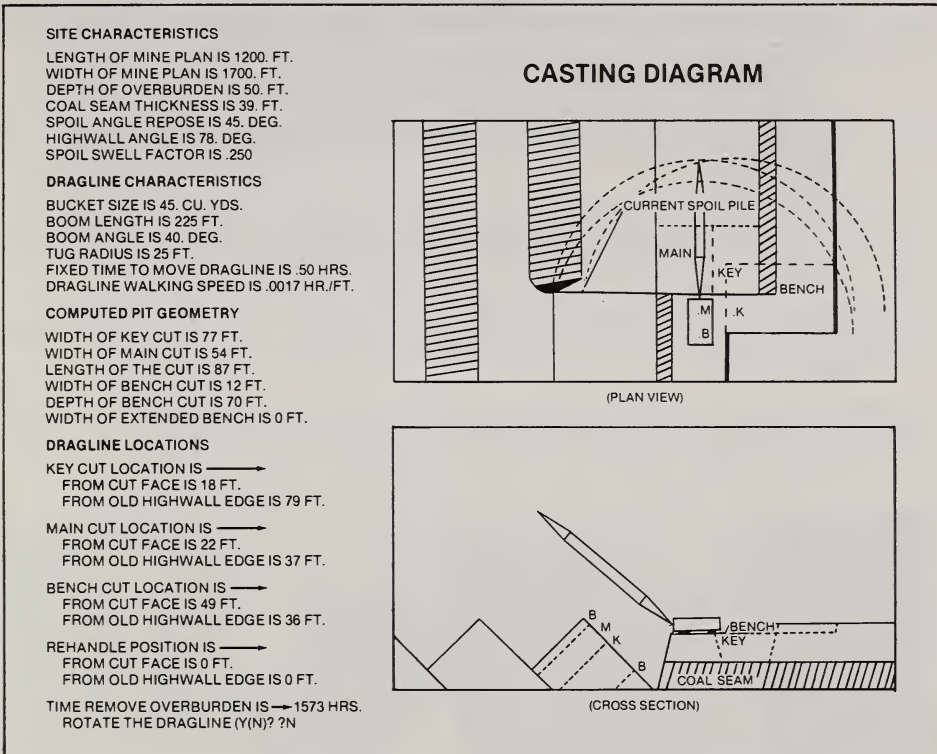
# PRODUCTION ANALYSIS

- Basic objectives are to provide design tools for the mining industry to evaluate effects of various mine plan decisions on costs, reclamation procedures, and environmental impacts.
- The production analysis module is composed of three distinct but interrelated design levels:

<b>Design Level</b>	<b>Analysis, Design, Evaluation</b>
<b>1</b>	Total Mine Plan <ul style="list-style-type: none"><li>— Transportation System</li><li>— Equipment Balance</li><li>— Interactions</li><li>— Loading, Hauling</li><li>— Production Analysis</li></ul>
<b>2</b>	Pit Design <ul style="list-style-type: none"><li>— Dragline Selection/Evaluation</li><li>— Box Cut Location</li><li>— Optimum Overburden Removal</li><li>— Optimum Placement of Spoils</li><li>— Optimum Move Sequence</li><li>— Optimum Pit Geometry</li><li>— Dragline Productivity</li></ul>
<b>3</b>	Detailed Evaluation <ul style="list-style-type: none"><li>— Swing by Swing Simulation</li><li>— Overburden Removal Sequence</li><li>— Spoil Configuration Sequence</li><li>— Dragline Performance<ul style="list-style-type: none"><li>Energy Requirements</li><li>Forces</li><li>Operating Statistics</li></ul></li></ul>

- At each level the user can interact with the system specifying parameters and decision variables and evaluating their effects on various criteria.
- Computational routines are available to aid the user in selecting the best mine plan by optimizing coal production using existing equipment or selecting equipment for given site conditions.

- Although the module is presently limited to single seam dragline mining, it can be adapted to include truck and shovel design.



## RECLAMATION ANALYSIS

- One of the primary principles for successful surface mine reclamation is to return the land to its most efficient land use.
- CLAIM is a computerized land reclamation subsystem within SEAMPLAN, and it has been developed to allow land planners to quickly and objectively analyze baseline data to arrive at a final land use decision.
- Answering questions posed by the computer, the user enters mining and environmental data into the CLAIM subsystem.
- CLAIM considers five uses that correspond to land use options in the new Federal surface mine laws:
  - Cropland
  - Rangeland (composed mostly of native species)
  - Wildlife management
  - Recreation (usually water oriented)
  - Intensive human use

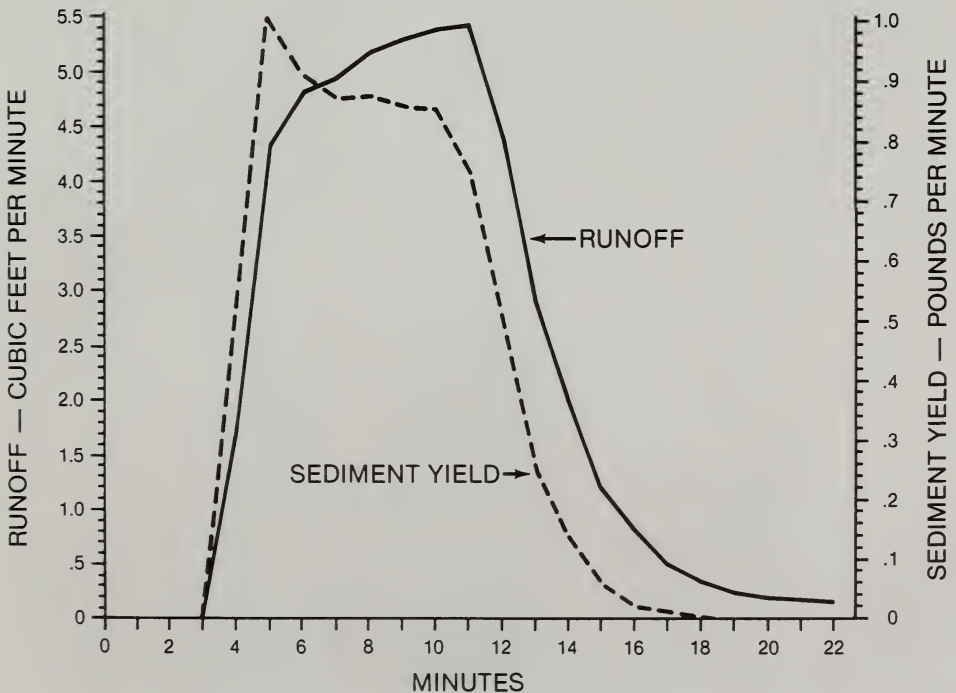
- The CLAIM reclamation planning subsystem:
  - Evaluates specific site data to develop a relative ranking of reclamation feasibility for each of the five land uses.
  - Prepares a list of specific reclamation techniques for each land use.
  - Calculates the costs for each technique and assigns the total reclamation cost to each land use.
  - Produces a final ranking of the five uses from best choice to poorest.
  - Calculates earthmoving volumes and grading costs for returning the land to topographic alternatives specified by the user.
- CLAIM operates on data from both dragline, and truck and shovel surface mines.
- Land planners without prior computer experience have operated the CLAIM subsystem after only 1-2 hours of briefing.





# IMPACTS ANALYSIS

- Accurate estimation of the environmental impact of surface mine activities is essential. Mine designs and reclamation strategies may need to be altered to avoid serious impacts.
- The impacts module includes the results of two studies with regional application:
  - A program to estimate the total amount of dust created by large coal and ore haulers, and the proportion of dust within several particle size classes. The prediction equation uses particle size gradation of the road surface material, gross truck weight, truck speed, and whether the road surface is wet or dry.
  - A program to estimate surface runoff and sediment yield from mine roads. This information may be used to determine the impact of road drainage upon surface streams, or to design sediment storage structures.
- Results of other studies will be added to the impacts analysis module as final reports are completed.



# AVAILABILITY OF INFORMATION

- SEAMPLAN serves as a prototype computer-based, interactive mine and reclamation planning system.
- The system, located on the campus of Montana State University, is available for demonstrations and expanded research work.
- All project results will be documented in reports, handbooks, and users' guides.
- Computer programs are available for the cost of reproduction and mailing.



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